Name _____ Class _____ Date _____

8-4

Angles in Polygons

Connection: Geometric Drawings

Essential question: *How can you draw shapes that satisfy given conditions?*

video tutor

CC.7.G.2

1 EXPLORE **Two Angles and Their Included Side**

Draw each triangle with the given conditions.

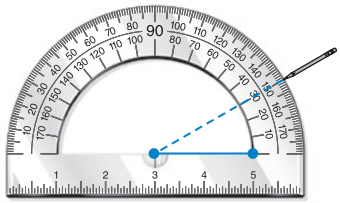
Triangle 1	Triangle 2
Angles: 30° and 80°	Angles: 55° and 50°
Included side: 2 inches	Included side: 1 inch

Use a ruler and a protractor to draw each triangle with the given angles and included side length.

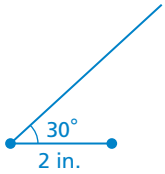
A Draw Triangle 1.

Step 1: Use a ruler to draw a line that is 2 inches long. This will be the included side.

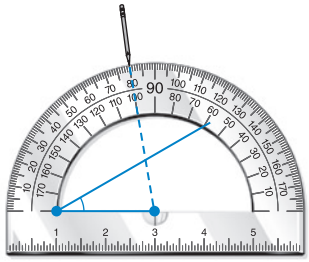
Step 2: Place the center of the protractor on the left end of the 2-in. line. Then make a 30°-angle mark.



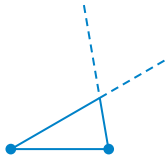
Step 3: Draw a line connecting the left side of the 2-in. line and the 30°-angle mark. This will be the 30° angle.



Step 4: Repeat Step 2 on the right side of the triangle to construct the 80° angle.



Step 5: The side of the 80° angle and the side of the 30° angle will intersect. This is Triangle 1 with angles of 30° and 80° and an included side of 2 inches.



B Draw Triangle 2.

REFLECT

1a. **Conjecture** When you are given two angle measures and the length of the included side, do you get a unique triangle?

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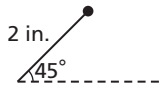
2 EXPLORE Two Sides and a Non-Included Angle

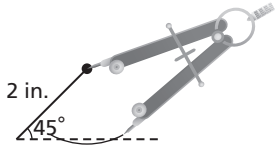
Use a ruler, protractor, and compass to construct a triangle with given lengths of 2 inches and $1\frac{1}{2}$ inches and a non-included angle of 45°. A non-included angle is the angle not between the two given sides.

Step 1: Use a ruler to draw a straight line. This will be part of the triangle, but does not have to measure a specific length.

Step 2: As in 1, place the center of the protractor on the left end of the line. Then make a mark at the correct 45-degree point. Use your ruler to make this side of the triangle 2 inches long.



Step 3: Make your compass the width of $1\frac{1}{2}$ inches. Place the sharp point on the end of the 2-inch side that you just drew in **Step 2**. Rotate the compass until it intersects, or meets, the bottom line twice (see figure).



Step 4: The point where the compass crosses the bottom line shows where a line can be drawn that is exactly $1\frac{1}{2}$ inches long. Use your ruler to verify the length and draw the line.

REFLECT

2a. Is there another triangle that can be drawn with the given conditions?

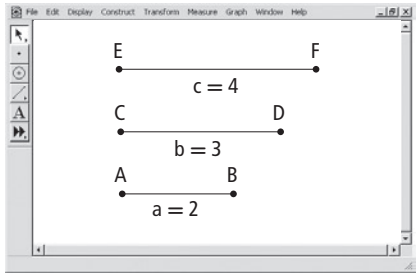
2b. When you are given two side lengths and the measure of a non-included angle, do you get a unique triangle? Explain.

CC.7.G.2

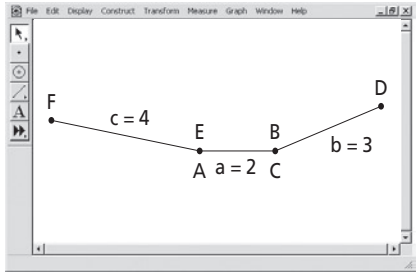
3 EXPLORE Drawing Three Sides

Use geometry software to draw a triangle whose sides have the following lengths: 2 units, 3 units, and 4 units.

Step 1: Draw three line segments of 2, 3, and 4 units of length.

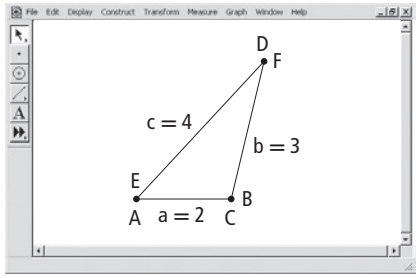


Step 2: Let $\overline{AB}$ be the base of the triangle. Place endpoint C on top of endpoint B and endpoint E on top of endpoint A. These will become two of the vertices of the triangle.



Step 3: Using the endpoints C and E as fixed vertices, rotate endpoints F and D to see if they will meet in a single point.

The line segments of 2, 3, and 4 units do /do not form a triangle.



TRY THIS!

3a. Repeat Steps 2 and 3, but start with a different base length. Do the line segments make the exact same triangle as the original?

3b. Use geometry software to draw a triangle with given sides of 2, 3, and 6 units. Do these line segments form a triangle?

REFLECT

3c. **Conjecture** When you are given three side lengths that form a triangle, do you get a unique triangle or more than one triangle?

PRACTICE

1. On a separate piece of paper, draw a triangle that has side lengths of 3 cm and 6 cm with an included angle of 120°. Determine if the given information makes a unique triangle, more than one triangle, or no triangle.

2. Use geometry software to determine if the given side lengths can be used to form one unique triangle, more than one triangle, or no triangle.

	Construction 1	Construction 2	Construction 3	Construction 4
Side 1 (units)	5	8	20	1
Side 2 (units)	5	9	20	1
Side 3 (units)	10	10	20	7
Triangle Formation?				

3. On a separate piece of paper, draw a triangle that has degrees of 30°, 60°, and 90°. Measure the side lengths.

a. Can you draw another triangle with the same angles but different side lengths?

b. If you are given 3 angles in one triangle, will the triangle be unique?

4. Draw a freehand sketch of a triangle with three angles that have the same measure. Explain how you made your drawing.

Additional Practice

Use a ruler, protractor, and compass to construct each figure.

1. Draw a triangle that has side lengths of 3 cm and 4 cm with an included angle of 90°. Determine if the given information makes a unique triangle, more than one triangle, or no triangle.

2. Draw a triangle that has angles that measure 45°, 45°, and 90°. Determine if the given information makes a unique triangle, more than one triangle, or no triangle.

Problem Solving

Use a ruler, protractor, and compass to construct each figure.

1. Draw a triangle that has sides that measure 5 cm, 5 cm, and 11 cm. Determine if the given information makes a unique triangle, more than one triangle, or no triangle.

2. Draw a triangle that has two angles that measure 30° and 40° with an included side length of 5 cm. Determine if the given information makes a unique triangle, more than one triangle, or no triangle.